Use of a multi wavelength integrating Nephelometer to determine particle concentration and size.

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Integrating Nephelometers are well proven scientific tools in the measurement of aerosol optical properties. Together with absorption measurements they allow the determination of the single scattering albedo and help to determining global warming issues. Extensive studies have been performed to generate a mass closure for optical measurements, where the scattering coefficient will be corrected with the growth factor for different particle contributions. Measuring the dry scattering coefficient eliminates the need for growth factor corrections and allows us to determine a volume or a mass scattering coefficient close to the mass value.

Multi-wavelength nephelometry allows for the determination of the scattering Ångström exponent. Since this factor is inversely related to particle size, it creates additional, useful and new possibilities in utilizing nephelometer data. The time series of the scattering coefficient represents the measured particle concentration and the corresponding Ångström exponent, which shows information relative to the average (mode) diameter of the measured particle distribution. Not only is this information delivered near real time, it adds the ability of identifying different aerosol groups[1], or size fractions e.g. by capturing the coarse particle influence on a daily average measurements which will be shown as an example at a near road side measurement station.

Using this method would, for instance, will allow a fixed measurement station to identify an influence of long-range transport of a special aerosol group, not normally measured at that site. If the total PM measurement for this period exceeds the daily limiting values, the additional information provided by the nephelometer could allow regulatory agencies to deduct that event from the normal site annual and daily averages PM value, and his could make the case that this "exceptional event" is outside the site's jurisdiction.[2] For a routine monitoring application, a changing Ångström exponent would indicate changes in the aerosol mix, site pattern could be generated by averaging the aerosol measurement over time and a significant deviation could be used to alert the user, e.g. by issuing a warning flag. With the stored measurement data, a detailed evaluation could subsequently be performed. With several stations utilizing this method, a geographical area could improve source apportionment studies as special aerosol characteristics of a given source could now be selectively be targeted.

References

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2. **US-EPA.** Code of Federal Regulations 40 part 50 Appendix K subtitle 2.4. [Online] 1997. [Cited: 11 29, 2014.] http://www.gpo.gov/fdsys/pkg/CFR-2004-title40-vol2/pdf/CFR-2004-title40-vol2-part50-appK.pdf.